

What is claimed is:

1. A lithium secondary cell comprising:

an inner electrode body impregnated with a non-aqueous electrolyte, made up of a positive electrode and a negative electrode each made of at least one metallic foil wound or laminated together; and

a positive electrode collector and a negative electrode collector to lead out a current from the inner electrode body,

wherein the edges of said metallic foils of said positive electrode and/or said negative electrode and predetermined parts of said positive electrode collector and/or said negative electrode collector are joined together to lead out a current from said inner electrode body, and

of the edges of said metallic foils, the arranged edges (joint edges) to be joined to said predetermined parts of said positive electrode collector and/or said negative electrode collector and said predetermined parts of said positive electrode collector and/or said negative electrode collector are joined together.

2. The lithium secondary cell according to claim 1, further comprising an electrode cover including internal terminals, external terminals and a cell cover, wherein said positive electrode collector and/or said negative electrode collector are connected to said internal terminals using electrode leads.

3. The lithium secondary cell according to claim 1, wherein said positive electrode collector and/or said negative electrode collector also serve as an electrode cover.

4. The lithium secondary cell according to claim 1, wherein said joint edges of said metallic foil constituting said positive electrode (positive electrode metallic foil) and a joint having a joint surface at the edge that extends from said predetermined part of said positive electrode collector to said joint edges are joined with the narrow end face of said joint edges facing said joint surface.

5. The lithium secondary cell according to claim 4, wherein said positive electrode metallic foil and said positive electrode collector are made of aluminum or an aluminum alloy.

6. The lithium secondary cell according to claim 1, wherein said predetermined part of said positive electrode collector is the edge of said positive electrode collector.

7. The lithium secondary cell according to claim 1, wherein said joint edges of said metallic foil constituting said negative electrode (negative electrode metallic foil) and a joint having a joint surface at the edge that extends from said predetermined part of said negative electrode collector

to said joint edges are joined with the side near said joint edges adhered to said joint surface.

8. The lithium secondary cell according to claim 7, wherein said negative electrode metallic foil and said negative electrode collector are made of copper or a copper alloy.

9. The lithium secondary cell according to claim 7, wherein said side is adhered to said joint surface by bending the part near said joint edges.

10. The lithium secondary cell according to claim 7, wherein columnar crystals are formed from said metallic foil toward said negative electrode collector at the joint between said negative electrode metallic foil and said negative electrode collector.

11. The lithium secondary cell according to claim 1, wherein said predetermined part of said negative electrode collector is the edge of said negative electrode collector.

12. The lithium secondary cell according to claim 4, wherein the joint between said joint edges of said positive electrode metallic foil and said predetermined part of said positive electrode collector (positive electrode joint) is formed by irradiating a convex part protruding toward said joint edges formed on said predetermined part of said positive electrode

collector with energy beams, melting said convex part of said positive electrode collector and welding said convex part of said positive electrode collector with said joint edges of said positive electrode metallic foil.

5 13. The lithium secondary cell according to claim 7, wherein
the joint between said joint edges of said negative electrode
metallic foil and said predetermined part of said negative
electrode collector (negative electrode joint) is formed by
irradiating a convex part protruding toward said joint edges
10 formed on said predetermined part of said negative electrode
collector with energy beams, melting said convex part of said
negative electrode collector and welding said convex part
of said negative electrode collector with said joint edges
of said negative electrode metallic foil.

15 14. The lithium secondary cell according to claim 1, wherein
said positive electrode collector and/or said negative
electrode collector is a cross-, Y- or I-figured tabular
collector or a circular collector with partial notching.

20 15. The lithium secondary cell according to claim 1, wherein
said positive electrode collector and/or said negative
electrode collector is formed of said convex part and other
flat part and the difference between the thickness (L_2) of
said convex part and the thickness (L_1) of said flat part is
0.1 mm or more.

16. The lithium secondary cell according to claim 15,
wherein the thickness (L_1) of said flat part of said positive
electrode collector is 0.4 mm or more.

17. The lithium secondary cell according to claim 12,
5 wherein the thickness (L_2) of said convex part of said
positive electrode collector is 0.6 mm or more.

18. The lithium secondary cell according to claim 12,
wherein when said positive electrode joint is formed, said
energy beam is irradiated onto said predetermined part at
10 an angle θ ($0^\circ < \theta \leq 90^\circ$) with respect to the normal to the plane
including said narrow end face of said positive electrode
metallic foil.

19. The lithium secondary cell according to claim 12,
wherein when said positive electrode joint is formed, the
15 power density of said energy beam at the irradiation point
is 3 kW/mm² or more.

20. The lithium secondary cell according to claim 15,
wherein the thickness (L_1) of said flat part of said negative
electrode collector is 0.2 mm or more.

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21. The lithium secondary cell according to claim 13,
wherein the thickness (L_2) of said convex part of said
negative electrode collector is 0.4 mm or more.

22. The lithium secondary cell according to claim 13,
5 wherein when said negative electrode joint is formed, said
energy beam is irradiated onto said predetermined part at
an angle θ ($0^\circ \leq \theta \leq 30^\circ$) with respect to the normal to the plane
including said side of said negative electrode metallic foil.

23. The lithium secondary cell according to claim 13,
10 wherein when said negative electrode joint is formed, the
power density of said energy beam at the irradiation point
is 6 kW/mm² or more.

24. The lithium secondary cell according to claim 15,
wherein when said negative electrode joint is formed, if the
15 thickness of said convex part is L_2 (mm) and said power density
is E (kW/mm²), the following Expression (1) is satisfied.
[Mathematical expression 1]

$$L_2 \leq E/7 \quad \dots (1)$$

25. The lithium secondary cell according to claim 13,
20 wherein irradiation point of said energy beam of said
negative electrode collector has a flat shape.

26. The lithium secondary cell according to claim 25,
wherein the spot diameter of said irradiation point is 1 mm
or less.

27. The lithium secondary cell according to claim 12,
5 wherein said positive electrode collector is placed in such
a way that said convex part crosses said narrow end face of
said positive electrode metallic foil at quasi-right angles.

28. The lithium secondary cell according to claim 12,
wherein said energy beam is irradiated onto said convex part
10 of said positive electrode collector at quasi-right angles
with respect to the line crossing said narrow end face of
said positive electrode metallic foil at quasi-right angles.

29. The lithium secondary cell according to claim 13,
wherein said negative electrode collector is placed in such
15 a way that said convex part crosses said side of said negative
electrode metallic foil at quasi-right angles.

30. The lithium secondary cell according to claim 13,
wherein said energy beam is irradiated onto said convex part
of said negative electrode collector at quasi-right angles
20 with respect to the line crossing said side of said negative
electrode metallic foil at quasi-right angles.

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31. The lithium secondary cell according to claim 12, wherein said energy beam is not directly irradiated onto said metallic foil.

32. The lithium secondary cell according to claim 1, wherein
5 neighboring metallic foils are placed with a certain gap kept in between.

33. The lithium secondary cell according to claim 12, wherein said energy beam is a laser or electron beam.

34. The lithium secondary cell according to claim 33,
10 wherein said energy beam is a continuous wave.

35. The lithium secondary cell according to claim 33, wherein said laser is a YAG laser.

36. The lithium secondary cell according to claim 12, wherein a joint material for supporting the joint between
15 said positive electrode collector and said positive electrode metallic foil is applied to said positive electrode metallic foil and/or said predetermined part of said positive electrode collector or inserted between said positive electrode metallic foil and said predetermined part of said
20 positive electrode collector and formed by irradiating said predetermined part of said positive electrode collector and said joint material with an energy beam and thereby melting

the two and welding said melted predetermined part of said positive electrode collector and said joint material to said joint edges of said positive electrode metallic foil.

37. The lithium secondary cell according to claim 13,
5 wherein a joint material for supporting the joint between said negative electrode collector and said negative electrode metallic foil is applied to said negative electrode metallic foil and/or said predetermined part of said negative electrode collector or inserted between said negative
10 electrode metallic foil and said predetermined part of said negative electrode collector and formed by irradiating said predetermined part of said negative electrode collector and said joint material with an energy beam and thereby melting the two and welding said melted predetermined part of said
15 negative electrode collector and said joint material to said joint edges of said negative electrode metallic foil.

38. The lithium secondary cell according to claim 1, which has a capacity of 2 Ah or more.

39. The lithium secondary cell according to claim 1, which
20 is to be mounted on a vehicle.

40. The lithium secondary cell according to claim 39, which is used for an electric car or hybrid electric car.

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41. The lithium secondary cell according to claim 39, which is to be used to start an engine.

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